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O. P. BRYSCH, Editor

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1. GAS INDUSTRY

Defense & Appliance Costs

Tennant, H. SPUTNIK & APPLIANCES. *Appliance Manufacturer 5*, 34-5 (1957) Dec.

The appliance industry can expect to be caught in the middle of the higher defense costs dilemma. Increased emphasis on defense, especially in the field of missiles and rockets, will mean cutting out or deferring entire categories of civilian activity.

Fuel Competition

Connole, W. R. ENERGY—ITS USE AND ABUSE. *Public Util. Fortnightly 60*, 836-45 (1957) Nov. 21.

Circumstances and areas of close interfuel competition, influenced by the conventional uses of the demand-commodity rate form for gas sales, create a basis for certain speculation. This speculation is that interruptible service customers may be accorded special price favors. It is indicated that if natural gas prices and coal prices on a national average basis continue their relative trends, natural gas prices will be beyond competing with coal sometime before 1960.

Gas Refrigeration Firms

Hale, D. TWO FIRMS PROMISE AGGRESSIVE SELLING IN BIDS FOR GAS REFRIGERATOR MARKET. *Am. Gas J. 184*, 4 (1957) Dec.

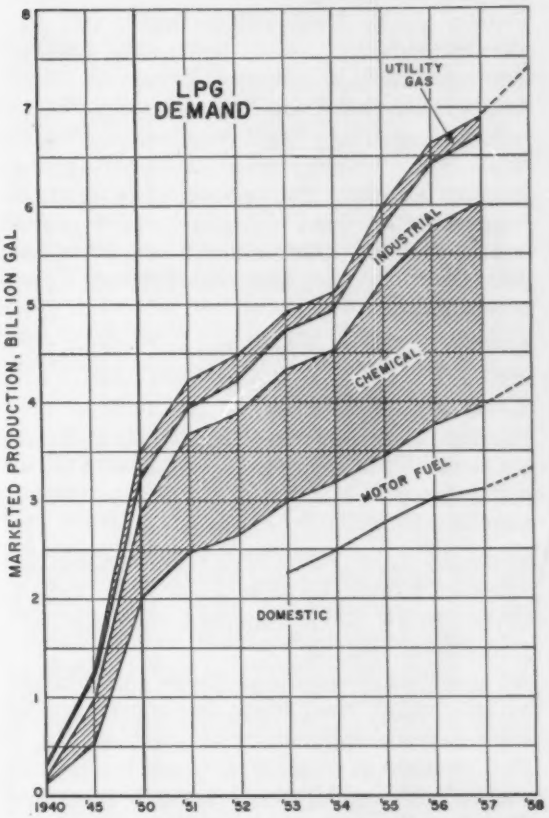
The vast home market for gas refrigerators, vacated by Servel, is seen as an important, new area of operation for two firms who haven't hesitated in their efforts to fill the void. The firms, Norco, Inc. of Los Angeles, and National Gas Appliance Corp. of Chicago, recently have announced their respective entries into the gas refrigerator appliance field. Both firms will market refrigerators utilizing imported equipment.

Gas Statistics, 1956

NATURAL GAS PRODUCTION AND USE REACHED ALL-TIME PEAK IN 1956. *Gas Age 120*, 9-12 (1957) Dec. 26.

Gross withdrawals from wells reached 12,373 billion CF in 1956, a gain of 5.6% over 1955. Marketed production was up 7% to 10,082 billion. Consumption rose 7% to 9,707 billion with the following breakdown: residential 2,328 billion; commercial 717 billion; field use 1,421 billion; and refineries 4,999 billion.

LPG MARKETED PRODUCTION SINCE 1940, AND FORECAST FOR 1958



(*Data from* BENZ, G.R. et al., *and* SERIF, M., p.60)

Pipeline Gas Purchases

PIPELINES ARE LARGE BUYERS, RELATIVELY SMALL PRODUCERS. *Gas Age 120*, 26-41, 7 (1957) Dec. 26.

In addition to the 6,163 billion CF purchased from producers last year, interstate pipeline companies produced 806.7 billion. Similar data are summarized from the annual report made to the FPC by natural gas companies listed. Natural gas purchases of 100,000 MCF or more annually are reported. Seven tables give data by years (1953-56), by states for all producers, for producers over 2 million MCF, by size group, by size of sales, and alphabetical by name.

2. APPLIANCES, DOMESTIC

Air Conditioning

Haines, J. E. THE ECONOMICS OF AIR CONDITIONING. *Gas Heat and Comfort Cooling 8*, 23-5, 65 (1957) Dec.

Cost evidence to justify the installation of air conditioning is assembled from recent country-wide data. Building cost data/sq ft/yr are itemized as cost of owning, operating and heating; machinery and equipment; and payroll costs. Building types covered are industrial, office, schools, hospitals, apartments, stores, hotels and new homes.

Newton, A. B. (assigned to the Coleman Co.) METHOD OF CONDITIONING AIR. U.S. 2,811,223 (1957) Oct. 29.

Silica gel is used to dehydrate the air and raise its sensible heat content. Cooling with direct water spray at temperatures below ambient is used to rehumidify the air.

Stukeman, H. C. ROCKWELL CHOOSES GAS ABSORPTION SYSTEM FOR AIR CONDITIONING IN FIVE PLANTS. *Gas Age 120*, 13-5 (1957) Dec. 26.

Air conditioning produced better work quality by eliminating fluctuations in temperatures of tools, fixtures and parts to be machined. A 5-10% increase in usable floor space, better-engineered light, and elimination of window maintenance costs were obtained.

Cookers

Schaefer, H. W. (assigned to Philco Corp.) SMOKE AND ODOR ELIMINATOR. U.S. 2,815,427 (1957) Dec. 3.

Catalytic incineration is used in elimination of the smoke and odors arising from use of cooking equipment on open-top cooking ranges.

European Appliances

Dunning, E. W. B. EUROPEAN MARKETS AND APPLIANCE DESIGN. Part 1. *Gas Times 41*, 660-1, 3 (1957) Nov. Part 2. *Ibid*, 718-9 Dec.

A brief discussion, in Part 1, of the European Economic Community gas production and possible sales of domestic gas appliances in these countries compared with Great Britain, followed by details of the approval requirements and the more important performance requirements. Part 2 explains the main differences between the U.S. and British appliances, especially the cookers, water heaters, dryers and refrigerators, with respect to possible sales competition.

Space Heating

Lowe, F. J. Jr. ADJUSTING THE CONVERSION BURNER. *Gas Heat and Comfort Cooling 8*, 26-8 (1957) Dec.

Conversion burner adjustments are outlined, with influence of secondary air, chimney draft balancing and flue gas composition on proper performance of burner.

COMMERCIAL AND INDUSTRIAL FINNED-TUBE RADIATION. *Air Conditioning, Heating, and Ventilating 54*, 72-82 (1957) Dec.

This staff report on finned-tube radiation reviews the types of heating elements and available styles of covers and enclosures from a number of manufacturers, with descriptive specifications presented in tabular form. The I-B-R rating code is noted.

DEALERS UPGRADE THE TRADE. *Gas Heat and Comfort Cooling 8*, 30-1 (1957) Dec.

To combat the shoddy jobs with attractive, low price tags which were driving out the quality heating installations of conscientious contractors and giving a bad name to the industry as a whole, reputable dealers in Cleveland whipped their weak association into strong, fighting shape. They have begun a program of Certified Heating and have undertaken to educate the consuming public as to what constitutes good heating.

Ventilation

White, T. T. FLUES FOR APPLIANCES WITH ROOM-SEALED COMBUSTION CHAMBERS: SOME THEORETICAL CONSIDERATIONS *J. Inst. Fuel 30*, 646-61 (1957) Dec.

Theoretical investigation of the performance of two flue systems having special application in the venting of multistory buildings. Validity of a flow equation based on considerations of the energy acquired and dissipated by the flue gases during their passage through a flue is confirmed. This forms the theoretical basis for the performance of individual flues, and a flow equation is derived relating the mass flow

through a flue with the physical constants of the flue system. Consideration of a system comprised of a single vertical duct open only at its ends and to which a number of appliances with room-sealed combustion chambers are fitted leads to proposed design data.

Water Heating

COMMERCIAL GAS WATER HEATER RENTAL PROGRAM IS BIG BUSINESS. *Gas Age 120*, 17-8, 27 (1957) Dec. 12.

A nine-dollar/month rental fee has built into a $1,000/unit net profit on commercial gas water heat. The program installed 352 units in 26 months.

3. COMBUSTION AND INDUSTRIAL FURNACES

Air Pollution

Grossman, P. R. DEVELOPMENTS IN SOLID FUEL BURNING EQUIPMENT IN AIR POLLUTION CONTROL. *J. Air Pollution Control Assoc. 7*, 222-6 (1957) Nov.

In summarizing the three factors in boiler design affecting the problem of air pollution, considerable improvement has been made during the past 30 years in reducing the quantity of coal burned/kwhr of electricity. Any further substantial reduction in pollution must come from lowering the present amounts of pollutants emitted. Developments in fuel burning equipment and boiler design have provided means for completely eliminating smoke, and for important reductions in dust emission.

Houdry, J. H. and Hayes, C. T. VERSATILITY OF OXIDATION CATALYSTS FOR INDUSTRIAL AIR POLLUTION CONTROL. *J. Air Pollution Control Assoc. 7*, 182-6 (1957) Nov.

Catalytic installations are usually associated to waste gases which are relatively free of catalyst poisons, such as metallic oxides and other noncombustible contaminants. Successful cases are discussed where catalysts are being used in the presence of materials generally believed to be deterrents to catalytic oxidation.

Tow, P. S. CONSIDERATIONS OF THE FEASIBILITY OF CONTROL OF OXIDES OF NITROGEN. *J. Air Pollution Control Assoc. 7*, 234-40 (1957) Nov.

The major factors involving oxides of nitrogen considered in this study are their role in ozone formation, nature and contribution of various sources, and state of present knowledge of control.

Burner Design

Eskin, S. G. and Legeza, T. B. (assigned to the Dole Valve Co.) GAS TEMPERATURE SHUT OFF VALVE. U.S. 2,815,035 (1957) Dec. 3.

A safety shutoff valve for gas burners in which the valve is held open by thermal electric current generated by the heat of the pilot flame. A thermostatically operated over-temperature safety release is provided for the valve, positively releasing the valve upon over-temperature conditions while the electromagnet holding the valve open is maintained energized.

Francis, W. E. and Jackson, B. JET BURNER DESIGN FOR PRESSURE EFFICIENCY USING AIR BLAST INJECTION. Research Commun. GC44, London: Gas Council, 1957; *Gas World 146*, 963-5 (1957) Nov. 23; *Gas Times 41*, 793 (1957) Dec.; *Gas J.* 292, 578-82 (1957) Dec. 11; *Coke and Gas 19*, 506-7, 18 Dec.

High-velocity tunnel burners, or jet burners provide higher convective heating rates for localized heating processes. Jet burners are also used as jet pumps to drive combustion products through industrial appliances using jet-driven recirculation.

Lamar, C. C. (assigned to Harper-Wyman Co.) VENTURI TUBE WITH AIR SHUTTER. U.S. 2,815,070 (1957) Dec. 3.

A new and improved thin-walled metallic venturi tube having uniform diameter tubular inlet and outlet ends. In an intermediate-finned venturi section, an air shutter may be slidably mounted upon and supported by the fins and the inlet end of the tube.

Cyclone Firing

BRITAIN'S FIRST CYCLONE-FIRED BOILER. *Fuel Efficiency 5*, 539-42 (1957) Nov.

Claimed to be one of the most efficient boilers in Britain, a new cyclone-fired boiler produces steam at 925 psi and 915°F. It has an output of 200,000 lb/hr, powering a turbine which can produce enough electricity to light a medium-sized town or city.

Explosion Damage

Jacobs, R. B., Bulkley, W. L., Rhodes, J. C. and Speer, T. L. DESTRUCTION OF A LARGE

REFINING UNIT BY GASEOUS DETONATION. *Chem. Eng. Progress 53*, 565-73 (1957) Dec.

Further studies on plant damage, fragment distribution and possible flame travel are reported for the fluid hydroformer explosion at Whiting, Indiana in 1955.

Randall, P. N., Bland, J., Dudley, W. M. and Jacobs, R. B. EFFECTS OF GASEOUS DETONATION UPON VESSELS AND PIPING. *Chem. Eng. Progress 53*, 574-80 (1957) Dec.

The principles involved in the rupturing of pipes and vessels by gaseous detonation, with pertinent engineering and metallurgical information on their relevance to the explosion at Whiting, Indiana in 1955.

Explosion Relief

Cubbage, P. A. and Simmonds, W. A. EXPLOSION RELIEFS FOR INDUSTRIAL DRYING OVENS. Part 2. BACK RELIEFS IN BOX OVENS: RELIEFS IN CONVEYOR OVENS. Research Commun. GC43, London: Gas Council, 1957; *Gas World 146*, 962-3 (1957) Nov. 23; *Gas Times 41*, 794 (1957) Dec.; *Gas J. 292*, 574-7 (1957) Dec. 11.

A previous paper on both vapor and gas explosions in empty cubical ovens with top reliefs, showed that the reliefs should be very much lighter and appreciably larger than was usual at that time. This paper discusses the various modifications needed in the earlier general case to match normal industrial operating conditions for box ovens. (See *Gas Abstracts 12*, 24.)

Flame Research

Biedler, W. T. III and Hoelscher, H. E. STUDIES IN A NEW TYPE OF FLAT FLAME BURNER. *Jet Propulsion 27*, 1257-60 (1957) Dec.

A new type of device for measuring flame velocities is a burner utilizing a stable planar flame front which permits the study of stable flat flames, free from contact with any surface. Flame velocity as a function of concentration of combustibles in the unburnt mixture has been determined for an air-propane system. The effect of the geometry of the system on flame properties is observed.

Duclos, D. P., Schaffer, A. and Cambel, A. B. FLAME STABILIZING EFFECTS OF INCLINED AIR JETS. *Ind. Eng. Chem. 49*, 2063-6 (1957) Dec.

Although in general a flame is stabilized with a bluff body, experiments have been made in which premixed propane-air flames were stabilized in a high velocity flow stream by means of a small gaseous jet injected in a direction of 180° to the mixture flow. Experiments were undertaken to determine the effect of incidence angle of the approaching mixture relative to the stabilizing jet.

Saunders, A. O. FLAME PROBLEMS IN INDUSTRY. SYMPOSIUM AT THE INSTITUTE OF FUEL. *Fuel Efficiency 5*, 554-5 (1957) Nov.

Early session dealt with researches in progress at the International Flame Radiation Research Foundation's research establishment at Ijmuiden, Holland, and with the possible applications of the data collected. Later session dealt with flame problems in industry under the headings of steel, glass, cement, steam-raising, and the gas turbine, and concluded with a theoretical paper on radiation heat-exchange.

Heat Conductivity

Grover, J. H. and Holter, W. H. SOLUTION OF THE TRANSIENT HEAT-CONDUCTION EQUATION FOR AN INSULATED, INFINITE METAL SLAB. *Jet Propulsion 27*, 1249-52 (1957) Dec.

The transient equation for the transfer of heat from hot combustion gases to an insulated, infinite metal slab has been solved. A graphical representation of the generalized solution has been prepared, as well as a graphical representation of a simplified, approximate solution of sufficient accuracy for engineering use. From these curves, the insulation required to protect a metal slab from hot gases can be determined.

Heat Treating

Helfat, J. N. LARGE OVEN FURNACE PROGRAM-CONTROLLED FOR VERSATILE HEAT TREATING. *Ind. Heating 24*, 2512, 4, 6 (1957) Dec.

Wide range of operating temperatures for the furnace (from 600°-2000°F) is possible because the firing system design employs twin-nozzle tunnel burners. When operating at lower temperatures, one nozzle introduces a supply of air which mixes with the hot products of combus-

tion from the second nozzle. At the higher temperatures, both nozzles fire for faster heating of the load.

Jack, H. R. S. and Richardson, D. A. COMPARATIVE FUEL TRIALS OF TWO GLASS MELTING FURNACES. *Ceramics 9*, 24-5 (1957) Dec.

Careful measurements of fuel consumption and heat distribution have been made on two identical furnaces of good and poor condition of repair but making the same amount of plate glass. Extracts from a report to the Institute of Fuel on the trials conducted are presented. One finding is that the furnace personnel play an important part in the magnitude of the unaccounted for heat losses.

Smith, A. Q. BRIDGEPORT BRASS GROWS BIG ON CONTINUOUS ANNEALING. *Ind. Gas 36*, 6-7 (1957) Dec.

Five gas-fired continuous furnaces used in the B.B. Co. tube mill.

Industrial Heating

HIGH TEMPERATURE GASEOUS JETS AND THEIR APPLICATION IN INDUSTRY. Part 1. *Ind. Gas 21*, 19-23 (1957) Nov. Part 2. *Ibid.* 11, 3-4, 6, 8-9 Dec.

Jets resulting from gaseous combustion possess numerous properties of economic importance to the process industries. Combustion of gas implies the use of a burner which is more technically a transducer. Nozzles designed for high-velocity jet applications function by compressed combustible mixture admitted through a diffuser into the combustion chamber where combustion is completed. Completely burnt combustion products issue from the exit nozzle at velocities dependent upon the physical properties of the combustion products and the nozzle pressure ratio. High convection heat-transfer coefficients, and the shear and drag upon the objects so heated, accelerate the heat transfer.

Geib, W. H. CONTROLLED HEAT BOOSTS GLIDPOL PRODUCTION. *Instrumentation 10*, 14-5 (1957) Nov./Dec.

Output of polyester resins is stepped up with new radiant-heated kettle and temperature control system. Furnace design, burner operation, and instrumentation all contribute to close control with the result that temperature extremes are avoided, batches are uniform, and fuel costs are kept to a minimum.

Smith, A. Q. WHY BULLARD PREFERS GAS FUEL IN MOST MODERN FOUNDRY. *Ind. Gas 36*, 3-4 (1957) Dec.

General use of gas fuel for all heating operations with the exception of basic iron melting which follows the usual cupola practices. Cupola smoke burners, ladle preheaters, core-baking ovens for large and small molds and cores are used.

Infrared Heating

Resek, M. GAS-FIRED INFRA RED. *Am. Gas J. 184*, 16, 8 (1957) Dec.

A gas-fired infrared generator which produces controlled far-infrared heat energy. The unit, consisting of a housing holding a ceramic mat, has a gas burner using 100% inspirated primary air and operates on the surface combustion principle to produce a glowing ceramic surface.

Wagner, O. R. HOW MILWAUKEE GAS LIGHT IS SELLING GAS-FIRED INFRA RED. *Am. Gas J. 184*, 17, 9 (1957) Dec.

In the fall of 1956, a direct mail campaign was initiated to introduce gas infrared heating to the industries in Milwaukee. Commercial installations are discussed.

Improved Coal Firing

Tobey, J. E. ADVANCEMENTS IN COAL-FIRING TECHNIQUES. *Coal Utilization 11*, 26-30 (1957) Dec.

Improved efficiency, advancements in design, and more favorable cost factors have marked the passage of this decade. Boiler research has resulted in better disposition of heating surfaces, better ratios of heat surface to heating volume, better heat absorption, lower furnace heat release in terms of Btu/ft^2, and higher super-heat temperatures. The future will bring new coal-burning steam generators as high as 300 ft., more big power stations located in coal fields, more long distance, higher voltage transmission, and cleaner smoke stacks.

O_2-CH_4 Detonation

Houser, C. R. and Harris, T. M. DETONATION OF LIQUID OXYGEN-LIQUID METHANE

SOLUTION. *Am. Chem. Soc. J. 79,* 6341-2 (1957) Dec. 5.

Liquid CO and CH_4 form clear homogeneous solutions with liquid O_2 over the whole composition range from 0-100% O_2. They are colorless on CH_4-or CO-rich side and gradually approach the color of liquid O_2 on the O_2-rich side. They detonate with great brisance.

Stack Gases

Hilst, G. R. THE DISPERSION OF STACK GASES IN STABLE ATMOSPHERES. *J. Air Pollution Control Assoc. 7,* 205-10 (1957) Nov.

A report on the attempt to measure the diffusion and transport of materials emitted continuously from an elevated point source into stably stratified atmospheres. It is concluded that the concentration of stack effluents is decreased significantly by large-scale meander. The diffusive capacity of stable atmospheres is quite variable; no single set of diffusion parameters can be assigned to stable atmospheres *per se.*

Nelson, H. W. and Lyons, C. J. SOURCES AND CONTROL OF SULFUR-BEARING POLLUTANTS. *J. Air Pollution Control Assoc. 7,* 187-93 (1957) Nov.

Remedies for the problem of controlling the undesirable effects of discharging waste or stack gases containing sulfur dioxides into the atmosphere are examined. The final conclusion is that none of the methods represents a final economical and practical answer. Whatever the solution, however, the costs of eliminating or minimizing the effect of the sulfur oxides in stack gases would be passed on to the consumer.

Strom, G. H., Hackman, M. and Kaplin, E. J. ATMOSPHERIC DISPERSAL OF INDUSTRIAL STACK GASES DETERMINED BY CONCENTRATION MEASUREMENTS IN SCALE MODEL WIND TUNNEL EXPERIMENTS. *J. Air Pollution Control Assoc. 7,* 198-204 (1957) Nov.

Wind tunnel scale model experiments are more useful when performed with sulfur dioxide concentration equipment. In application to air pollution problems of industrial plants the effect of plant configuration and stack parameters can be evaluated more effectively.

Superfuels

NEW ROCKET FUEL STAR? *Petrol. Week 5,* 50-1 (1957) Dec. 13.

A new rocket fuel believed to be pentaborane, B_5H_9, with a heat release on combustion of 29,127 Btu/lb (compared to 18,800 Btu for gasoline) has been developed to a plant construction stage. New work on decaborane, $B_{10}H_{14}$, with 28,000 Btu heat release, is in progress.

4. GASIFICATION AND CARBONIZATION

Aromatics Refineries

COKE OVENS CLEAN UP FOR NEW COMPETITION. *Chem. Week 81,* 64-6 (1957) Dec. 14.

With the recent startup of a $2-million-plus refining plant at Jones & Laughlin Steel Corp.'s Aliquippa, Pa. coke ovens, coal chemicals drove an opening wedge into the high-purity aromatics field, long dominated by products derived from petroleum. Capacity of J&L's refining plant is 56,500 gal/day of BTX (about 70% benzene, 20% toluene, and 10% mixed xylenes). U.S. Steel is building a plant to refine an estimated 150,000 gal/day of crude coke-oven light oil of similar BTX composition.

Coal Gasification

Crane, K. J. GAS-MAKING PROCESSES IN THE BRITISH GAS INDUSTRY. *J. Inst. Fuel 30,* 661-72 (1957) Dec.

Combined distillation and gasification processes at atmospheric pressure are being developed to utilize weakly caking coals and research on the high-pressure gasification of such coals is receiving urgent attention. Most remarkable change in recent years is the development of catalytic processes which produce a satisfactory town gas from medium and heavy fuel oils, and are used to reform tail gases. A search for natural gas continues, and the possibility of importing the gas in a liquefied state from overseas is being investigated.

Grant, A. F. and Lewis, C. H. THE GAS INTEGRALE PLANT AT KENSAL GREEN. Commun. 514, London: Inst. Gas Eng., 1957; *Gas J. 292,* 453-7 (1957) Nov. 27; *Gas World 146,* 977 (1957) Nov. 23; *Ibid.* 1166-70 Dec. 21; *Gas Times 41,* 785-7 (1957) Dec.

Detailed results of tests of complete gasification

of Types 802 coals on two different operating cycles are reported, together with description of test methods. The preliminary nature of the work reported is emphasized, and further work to improve performance and to study the behavior of the plant with different coals is envisaged. Modifications to improve efficiency are indicated, and some estimated operating costs are given.

Koppers, H. H. THE KOPPERS-TOTZEK GASIFICATION PROCESS. *J. Inst. Fuel 30,* 673-80 (1957) Dec.

The installation and operation of a plant for the gasification of coal dust and of heavy oil are discussed. Arguments against the gasification of coal dust under pressure are included. The additional scope of the process in the future is considered. The process may open new fields for synthesis gas in the chemical and perhaps metallurgical industries.

Coke-Oven Gas

Greenwood, H. D. A REVIEW OF THE PRODUCTION AND UTILIZATION OF COKE OVEN GAS IN GREAT BRITAIN. *Gas World 146,* 129-38 (1957) Dec. 7.

Present production and utilization of coke-oven gas in Britain. An increase of 30% in production, with 60% from the iron and steel coke ovens has raised coke-oven gas to about 60% of the gas produced by the industry. Problems still exist regarding variation in demand and flexibility of supply.

Hydrocarbon Gasification

Myhill, A. R. PROCESSES FOR THE MANUFACTURE OF GAS FROM OIL. *Coke and Gas 19,* 408-11, 5 (1957) Oct.; *Ibid.* 448-51 Nov.; *Ibid.* 493-9 Dec.

Direct thermal cracking in the presence of steam without a catalyst such as the Jones, Hall and Semet-Solvay processes are described. The Segas process, using the lime-magnesia catalyst, is treated in Part 2, with the inclusion of results from Sydenham and York plants, and proposed improvements for the Ponders End plant. Part 3 reviews the Onia-Gegi, the Dent high-pressure, fluidized oil-hydrogenation process, the MacCormac "cracking flame" process for distillates, and the Hercules catalytic reforming process.

Ward, E. R. USE OF LIGHT PETROLEUM DISTILLATE FOR GAS MAKING. Commun. 515, London: Inst. Gas Eng. 1957: *Gas World 146,* 979-82 (1957) Nov. 23; *Gas Times 41,* 787 (1957) Dec.; *Gas J. 292,* 586, 91-2 (1957) Dec. 11.

Carbureted water gas and "Segas" processes were used at the Sydenham Works of the South Eastern Gas Board. The carbureted water gas plant experiment showed that the light distillate could be reformed successfully in the fuel bed on the back run to produce a gas of a calorific value just below 400 Btu/CF, and that further quantities could be added to the carburetor to enrich to 500 Btu/CF.

Hydrogasification

Shultz, E. B. Jr. and Linden, H. R. BATCH HYDROGENOLYSIS REACTIONS OF PURE COMPOUNDS RELATED TO PETROLEUM OILS. *Ind. Eng. Chem. 49,* 2011-6 (1957) Dec.

Batch thermal hydrogenolysis reactions of C_6 to C_{12} normal paraffins, and C_6 cyclic hydrocarbons were studied at an initial hydrogen pressure of 1275 psig and a hydrogen/hydrocarbon ratio of 0.07 lb-mole/lb. Data on gaseous products were obtained at reactor temperatures up to 1300°F. The major products, methane and ethane, were produced in nearly equimolar quantities during the initial phases of hydrogenolysis, although less ethane was produced from cyclic compounds, particularly aromatics.

Hydrogenation

Hiteshue, R. W., Anderson, R. B. and Schlesinger, M. D. HYDROGENATING COAL AT 800°C. *Ind. Eng. Chem. 49,* 2008-10 (1957) Dec.

Coal hydrogenation at 6,000 psi, 800°C and short residence time. A semicontinuous apparatus that can almost instantaneously heat and cool the coal charge was developed using the reactor as a resistance in a low voltage, high amperage circuit and by spraying with cold water. At a residence time of one min, 48% of the coal was converted to gaseous hydrocarbons and about 10% into aromatic oils.

Indian Coke Ovens

Choulat, G. BESCHREIBUNG DER KOKEREIANLAGE DURGAPUR DER WESTBENGALISCHEN REGIERUNG IN INDIEN (UNTER BESONDERER BERUECK-

SIGHTIGUNG DER KOHLENWERTSTOFFANLAGE) (DESCRIPTION OF THE COKE OVEN PLANT AT DURGAPUR, WEST BENGAL, INDIA, WITH SPECIAL REFERENCE TO THE COAL CHEMICAL PRODUCTS PLANT). *Gas u. Wasserfach 98,* 1163-78 (1957) Nov. 22.

A complete coke-oven and coal-chemical recovery plant has begun operations at Durgapur, 170 km (100 miles) northwest of Calcutta. Two batteries of Carl Still ovens (total 58) are carbonizing 1500 tons/day of Dishargar coal. Tar, ammonia, naphthalene, and benzene products are recovered. Gas, now burned under boilers, will be sold to pipelines in the future.

Methanol for Peak Gas

Cockerham, R. G. and Percival, G. PEAK GAS FROM METHANOL AND LIGHT PETROLEUM DISTILLATE. Research Commun. GC41, London: Gas Council, 1957; *Gas World 146,* 971-3 (1957) Nov. 23; *Ibid.* 1071-2, 4 Dec. 7; *Gas J. 292,* 527-32 (1957) Dec. 4; *Gas Times 41,* 788 (1957) Dec.; *Coke and Gas 19,* 500-6 (1957) Dec.

Laboratory experiments indicate the possibility of producing town gas from methanol by a catalytic process that should be specially suitable for peak loads. The process would operate under pressure without using oxygen and would permit high outputs from plant units of simple design. Maximum temperatures would not exceed 700°C, and operating would be continuous and could be automatic.

Refinery Gas Line

Copp, A. D. L. THE SHELLHAVEN-ROMFORD REFINERY GAS PIPELINE OF THE NORTH THAMES GAS BOARD. Commun. 518, London: Inst. Gas Eng., 1957; *Gas J. 292,* 457-9 (1957) Nov. 27; *Gas Times 41,* 809-10 (1957) Dec.

The planning, acquisition of a right-of-way, materials used for construction and the actual work of a 24-in. British pipeline for refinery gas built in 1957.

Synthesis Gas

Ashley, K. D., Stamford, C., Federman, S. I. and Innes, W. B. (assigned to American Cyanamid Co.) CARBON MONOXIDE CONVERSION CATALYST AND METHOD OF PREPARING SAME. U. S. 2,815,331 (1957) Dec. 3.

The preparation and commercial processes employing a chromium oxide-promoted iron oxide catalyst to be used in the water-gas shift reaction for the production of gaseous mixtures containing carbon monoxide, carbon dioxide and hydrogen.

Fitz, W. DIE ERZEUGUNG VON SYNTHESEGAS IN STETIG BETRIEBENEN VERTIKALKAMMEROEFEN (PRODUCTION OF SYNTHESIS GAS IN CONTINUOUS VERTICAL CHAMBER OVENS). *Gas u. Wasserfach 98,* 1178-83 (1957) Nov. 22.

Beginning with 16 Koppers GmbH continuous vertical ovens in 1933, the Ube Chisso Kogyo KK has grown to the present 68 ovens, with a throughput of 600 tons/day of Ube coal. By steaming in the base of retort, about 1000 m^3 (35 MCF) of mixed coal and water gas are produced per ton coal. The plant yields 520,000 m^3 (about 20 MMCF) synthesis gas/day, which is mixed with gas from oxygenated-blast generators operating on the semi-coke from the verticals and combined gases are purified for use in NH_3 synthesis.

Sprague, T. S. and Marquez, C. L. Jr. (assigned to the Babcock & Wilcox Co.) SYNTHESIS GAS GENERATOR. U.S. 2,815,007 (1957) Dec. 3.

A superheated-steam generator integrated with a synthesis-gas reactor advantageous in a gas synthesis utilizing coal provides process steam at a controlled optimum temperature, water-tube protection for the shell, reduces the temperature of the synthesis gas to an optimum low value, provides excess steam for other work and has reaction chambers above ash slagging temperatures.

Underground Gasification

UNDERGOUND GASIFICATION AT NEWMAN SPINNEY. *Chem. and Ind.,* 1565-7 (1957) Nov. 30; *Gas Times 41,* 821 (1957) Dec.; *Coke and Gas 19,* 492 (1957) Dec.

The experimental work at Newman Spinney, operated by the National Coal Board in 1956, has been under development by Humphreys and Glasgow, Ltd., who are building a five megawatt pilot plant power unit. The horizontal boreholes are drilled 250 ft into the coal seam, and blown with air (oxygen) through alloy pipes.

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Carbon Black

CARBON BLACK SWITCH—BUT NO SLUMP IN USE. *Chem. Week 82,* 51-2, 4 (1958) Jan. 4.

Carbon black production in the U.S. for 1957 totaled 1.84 billion lb, almost equivalent to 1956 output. Notable fact is increased shift in source of carbon; production from liquid hydrocarbons exceeded the billion lb per year mark. Projected estimates for 1975 indicate that liquid-derived black will constitute 85% of the nation's output, largely because of the rubber industry's preference for this material.

Compression

Gotterba, C. E. MAINTENANCE OF CONVERTED GAS ENGINES. *Gas 33,* 97-100 (1957) Dec.

Cleaning, lubrication, cooling and ignition are discussed. Cost of maintaining each compressor ($180/hp) has increased 10%, but the maintenance cost per delivered horsepower is less.

Sterrett, E. TEXAS EASTERN'S GAS TURBINE COMPRESSOR STATIONS. *Pipe Line News 29,* 25-33 (1957) Dec.

Power from a portion of natural gas throughput is generated instead of reliance on local electric power sources. In such stations the gas turbine finds a place, directly coupled to centrifugal compressors. Stations at Athens, Ohio, and Gransville, Pa. are described in detail.

Dehydration

Mitchell, K. G. GLYCOL FOR NATURAL GAS DEHYDRATION. *Pipe Line Ind. 7,* 36-40 (1957) Dec.

Of the liquid desiccants used in the dehydration of natural gas, diethylene and triethylene glycol have proved the most practical. Certain chemical and physical properties of these materials are considered for the design and operation of dehydration units.

Sattler, R. E. and Davison, J. W. (assigned to Phillips Petroleum Co.) DEHYDRATION OF GASES. U.S. 2,812,830 (1957) Nov. 12.

Dehydration of a wet hydrocarbon gas is achieved by mixing triethylene glycol containing some moisture with incoming gas, cooling, passing the mixture to a separator from which gas is sent to a conventional absorber using lean triethylene glycol as a final drying liquid. The partially moist glycol from this absorber is used in the first mixing stage, from which the separated saturated glycol is sent to a stripper to produce the lean glycol.

Turner, N. C. (assigned to Hudson Engineering Corp.) GAS DEHYDRATION APPARATUS AND PROCESS. U.S. 2,815,089 (1957) Dec. 3.

In the alternate dehydration- regeneration cycle of a pair of gas dehydrating units wherein the regeneration is accomplished by a flow of heated gas to heat the desiccant, an improvement is claimed comprising a reversal or downflow of regenerating hot gas to avoid condensation and retention of moisture in the top (outlet) of regenerated unit.

Worley, M. S., Johnson, H. L. Jr. and Keel, L. B. Jr. (assigned to Black, Sivalls & Bryson, Inc.) GAS DEHYDRATION PROCESS AND APPARATUS. U.S. 2,812,827 (1957) Nov. 12.

In a skid-mounted wellhead dehydrator unit, freezeups of knockout water are avoided by warming the water-decanting chamber with heat from the exhaust gases from the reconcentrated reagent pump.

Drilling

Angel, R. R. VOLUME REQUIREMENTS FOR AIR OR GAS DRILLING. *J. Petrol. Tech. 9,* 325-30 (1957) Dec.

Drilling rate is a parameter that should be considered in determining the volume requirements for air and gas drilling. A vertical-flow equation is presented for determining volume requirements. A simple approximate method of determining volume requirements is presented. Sample curves are given of calculated bottom-hole pressures for air and gas drilling in several hole sizes.

Bobo, R. A. and Boudreaux, S. KEYS TO SUCCESSFUL COMPETITIVE DRILLING. *World Oil 145,* 125, 9-30, 2 (1957) Dec.

Reduced-pressure drilling is defined as the drilling with a circulating medium whose effective

return column (annular) density is less than that of the muds which are in common use. It has two categories—air or gas drilling and aerated mud drilling. Aerated mud has as its primary purpose the remedy of loss of circulation. Lately, investigation was made to utilize aeration as a means of increasing penetration rates and bit footage, with the primary objective of overcoming some of the disadvantages of air drilling.

Jones, M. B. DEVELOPMENT OF GAS DRILLING AND GAS WELL COMPLETIONS IN SAN JUAN BASIN. *Petrol. Eng. 29,* B64-5, 8, 77-8 (1957) Dec.

Gas drilling, dry-hole cementing, fracturing with water and the use of ball-sealers combine to chop San Juan well costs. Fracturing injection rates are now under study in field tests.

Studer, E. A. MAGNETIC COUPLING AND MAGNETIC-PARTICLE BRAKE. *Oil Gas J. 55,* 55-60 (1957) Dec. 23.

The dynamatic brake, an eddy-current electromagnetic dynamometer, has been adapted as an auxiliary draw-works brake for 16 years. There are now about 400 applications of the eddy-current brake in use as auxiliary draw-works brakes in domestic and foreign oil fields. Improvements are discussed.

Exploration

Cooper, V., Tatum, J. L. and Budd, H. BIGGER THINGS AHEAD FOR BOOMING FOUR CORNERS. *Petrol. Eng. 29,* B21-5 (1957) Dec.

Current oil and gas activity, history, and future prospects are briefed for the Four Corners area. Proved reserves of 20 trillion CF of gas and 500 million bbl of oil have been developed in seven years, chiefly from Pennsylvanian strata. Future prolific areas are expected in all Paleozoic formations.

Levorsen, A. I. NEW CONCEPTS ALTER GEOLOGICAL THINKING. *World Oil 145,* 105-6, 15 (1957) Dec.

In the coming era of intensified stratigraphic exploration for petroleum, the geologist, who may be specialized as a petroleum geologist, a geophysicist, a paleontologist, a well-site geologist, a structural geologist, a subsurface geologist, or just a plain garden-variety geologist interested in petroleum exploration must drop some of his reliance on structure as a complete guide to exploration if he is to be successful.

Woodward, H. P. MULTIPLE FOLDING IN THE APPALACHIAN BASIN. *World Oil 145,* 110-2, 5 (1957) Dec.

There were at least three separate epochs of folding and deformation in the Appalachian oil and gas basin, each of which produced structures competent to act as reservoir traps. As the three orogenies were widely spaced in time, their trends and areas affected do not precisely match. A detailed historical analysis is made on the area.

Hydrate Prevention

Laird, J. BEAT THE FREEZE! *Pipe Line Ind. 7,* 46 (1957) Dec.

Anhydrous ammonia has proved effective in controlling hydrate formation in gas pipelines. Under certain conditions, it is as effective as alcohol and easier to inject into the line. However, certain safety precautions must be observed.

Leakage

Scott, M. J. GAS LEAK SURVEY AND REPAIR PROGRAM. *Am. Gas J. 184,* 14-5 (1957) Dec.

Techniques such as over-odorization, leak records, and preventive maintenance are used in a new program of leak detection.

Liquefied Gas

Morrison, W. L. (assigned to Constock Liquid Methane Corp.) METHOD FOR LIQUEFYING NATURAL GAS AT CASING HEAD PRESSURE. U.S. 2,814,936 (1957) Dec. 3.

Natural gas at wellhead pressure is first cooled, then expanded to further cool and liquefy higher boiling constituents. The remaining methane is then expanded by doing work in a turbine to cool some gas to the liquefaction temperature of methane. The liquid methane is then drained.

Poethig, R. E. and Billington, E. R. (assigned to the Bastian-Blessing Co.) APPARATUS FOR LIQUID FILLING OF PRESSURE STORAGE TANKS. U. S. 2,813,402 (1957) Nov. 19.

A sliding check-valve mounted in the dip pipe of a liquefied gas storage pipe opens to permit

radial spraying of inflowing liquid from ports at the top of the pipe. Such spraying agitates and cools the vapor and liquid in the tank, permitting rapid filling through one inlet line without venting vapor.

VENEZUELA GAS TO BRITAIN IN '58. *Petrol. Week 5,* 47 (1957) Dec. 20.

A 3000-ton cargo ship is being remodeled to carry liquefied natural gas from Venezuela to Britain.

LP-Gas Drive

Taylor, D. M. PILOT LPG INJECTION UNDERWAY AT BISTI. *Petrol. Eng. 29,* B38-9, 42-4 (1957) Dec.

Promising technique may ultimately recover over half the field's estimated 100 million bbl of oil originally in place at Bisti field, New Mexico.

LP-Gas Prediction, 1958

Serif, M. FORECAST FOR 1958. *LP-Gas 18,* 31-2 (1958) Jan.

Producers supplying over 70% of total marketed LPG predict sales gains in 1958: total gallonage sales up 7.2%; internal combustion use, 11.6%; domestic-commercial gallonage, 6.6%; and industrial sales, 3.5% (*see graph, p. 1*).

LP-Gas Sales, 1957

Benz, G. R., DeVoe, W. F. and Tucker, P. W. 1957 L.P. GAS SALES UP 4.1%. *Butane-Propane News 20,* 33-7 (1958) Jan. *Petrol. Eng. 30,* C13-5 (1958) Jan.

Tabulation of LPG sales since 1922 shows 1957 increase in sales volume lower than in recent years—as compared to 10.6% gain in 1956 and 17.0% in 1955. Greatest loss was in reduced use of LPG in gas manufacturing (*see graph, p. 1*).

Meter Test Cycles

Kyhos, A. F. CASE HISTORY: MONTANA-DAKOTA'S EXPERIENCES WITH TEST FREQUENCY OF GAS METERS. *Am. Gas J. 184,* 21-3 (1957) Dec.

A five-year test cycle is used for domestic meters in Montana and an eight-year periodic cycle in Wyoming, North Dakota and South Dakota. Of the total meters, 36,000 are on a five-year cycle and 54,000 are on an eight-year cycle.

Offshore Equipment

FLOATING PLATFORM ON STILTS. *Can. Gas. J. 50,* 17 (1957) Dec.

New type of offshore drilling equipment announced by Long Point Gas & Oil for the largest offshore drilling acreage of any company operating on Lake Erie (over 161,999 acres).

Pipeline Control

Wright, D. AUDIO CONTINUOUS-TONE EQUIPMENT SAVES MONEY FOR WESTERN UTILITY. *Gas 33,* 55-8 (1957) Dec.

Through the use of new equipment, two leased wire lines are now doing a job that formerly required several. In addition to saving money, telemetering is more efficient.

THE SUI PIPELINE CONTROL CENTRE. *Progress* (Pakistani) *2,* 4-5 (1957) Dec.

The nerve center of the 347-mile long high-pressure Sui Karachi gas transmission line, and the various distribution lines, is the Pipeline Control Center at Karachi Terminal. At the Center, an hour-by-hour picture is produced by gas control operators who are on duty 24 hrs/day.

Reservoir Engineering

Aronofsky, J. S. and Heller, J. P. A DIFFUSION MODEL TO EXPLAIN MIXING OF FLOWING MISCIBLE FLUIDS IN POROUS MEDIA. *J. Petrol. Tech. 9,* 345-9 (1957) Dec.

A mathematical analysis of the fluid mixing which occurs during flow through porous media. The analysis is based on the well-known diffusion equation with a mass transfer term. Calculated numerical values compare closely with some published results of experiments in which no viscosity or density difference existed between displaced and displacing fluids.

Baptist, O. C. and White, E. J. CLAY CONTENT AND CAPILLARY BEHAVIOR OF WYOMING RESERVOIR SANDS. *J. Petrol. Tech. 9,* 57-9 (1957) Dec.

Samples of four reservoir sands having different degrees of water sensitivity were subjected to several laboratory tests to determine differences in capillary behavior attributable to clay-mineral effects. The degree of water sensitivity was estimated by the difference between gas and water permeability.

Geertsma, J. THE EFFECT OF FLUID PRESSURE DECLINE ON VOLUMETRIC CHANGES OF POROUS ROCKS. *J. Petrol. Tech. 9,* 331-40 (1957) Dec.

In order to obtain a better insight into the pres-

sure-volume relationship of reservoir rocks a theory of pore and rock bulk volume variations is presented. The theory is independent of the shape of the pores but is restricted to isotropic porous media built up of continuous homogeneous matrix material. Reasonable approximations are introduced for various types of reservoir rock, e.g. sandstones, limestones, and shales, which lead to further simplifications of the basic formulas. The application of the theory to reservoir studies is discussed.

Kimbler, O. K. and Caudle, B. H. NEW TECHNIQUE FOR STUDY OF FLUID FLOW AND PHASE DISTRIBUTION IN POROUS MEDIA. *Oil Gas J. 55,* 85-8 (1957) Dec. 16.

A photographic technique has been developed to observe fluid displacement over large areas of porous media while at the same time detailing the individual pore spaces. Displacement studies have been made on residual gas and residual oil distribution, gas evolution, and high rate two-phase flow.

Stewart, R. E. FIGURING NET PAY IN CARBONATE RESERVOIRS. *Oil Gas J. 55,* 64-8 (1957) Dec. 16.

Interpretation of logs of heterogeneous limestones is quite difficult because of the high contrast between formation resistivity and the mud resistivity. The combination of logging methods that has proved to be quite successful for the determination of net pay in carbonate reservoirs is the gamma ray-neutron, guard, and guard-contact logs.

Trube, A. S. COMPRESSIBILITY OF UNDERSATURATED HYDROCARBON RESERVOIR FLUIDS. *J. Petrol. Tech. 9,* 341-4 (1957) Dec.

The foundations underlying the physical determination of instantaneous isothermal coefficients of expansion (compressibility). A graph, which relates the pseudo-reduced compressibility of undersaturated liquids with reduced pressures and temperatures, is presented together with correlations designed to place actual complex liquid mixtures on the graph.

Well Practice

Crawford, P. B. and Kennedy, H. T. PERLITE ADDITIVE IMPROVES CEMENT CHARACTERISTICS. *World Oil 145,* 117-20, 2-3 (1957) Dec.

An additive of expanded and unexpanded perlites gives a lighter slurry with better strength and setting properties that will perforate without shattering.

McConnell, L. V. PROS AND CONS OF JET AND BULLET PERFORATORS. *World Oil 145,* 169-70, 7 (1957) Dec.

A guide for maximum perforating efficiency under various well conditions, with a comparison of the efficiency of each type gun for a given situation.

Sanmann, F. M. MISSISSIPPI LIME DEVELOPMENT PROBLEMS. *World Oil 145,* 107-9 (1957) Dec.

Current information to date indicates that where there are other producing zones and where proper caution and completion methods are employed, there is no reason why the Mississippi Lime production cannot show a profit.

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Critical Outlook

1958 OUTLOOK. OIL FACES A CRITICAL YEAR—BUT NOT ONE OF GLOOM. *Petrol. Week 5,* 9-13 (1957) Dec. 27; *Petrol. Refiner 36,* 221-2, 5 (1957) Dec.

Petroleum's economic growth will enter one of its cyclic periods of tapering off in 1958. But it will taper off at a very high plateau. That is the concensus of top industry officials and petroleum economists across the country. The indications are that total demand will average 9,543,000 bbl/day for 1958, 0.5% gain over the 9,495,000 bbl/day for 1957. The gain in 1957 over the previous year ran only 3.4%. The exceedingly small gain is due to a sharp decline in exports and the expectation of only a modest gain in domestic demand.

Drilling Operations

Edmondson, C. WHY NOT A ROUGHNECK TRAINING SCHOOL? *Drilling 19,* 71-3, 92 (1957) Dec.

An organized training program to build up a ready reserve of potential roughnecks is needed. In view of the extraordinary success of a Texas drilling school, the training could be set up along the same line or even in conjunction with it.

McLaughlin, P. L. PUSH NEEDED TO REALIZE EFFECTIVE AIR DRILLING CON-

TRACTUAL CLAUSES. *Drilling 19*, 82-3 (1957) Dec.

Contractual relationships between oil company and drilling contractor seriously curtail progress. Realistic appraisal and intelligent planning can mean profit for both.

Mead, H. N. A BASIC CONCEPT OF CAPITAL BUDGETING FOR PETROLEUM OPERATIONS. *Petrol. Week 29*, B89-90, 9-100 (1957) Dec.

A capital budgeting procedure applicable to any oil producing company which intends to drill exploratory holes. Two capital budgets, one for exploration, and the other for development and production of known reserves, will enable the company to compare future known revenue to the cost of risking future money in exploration.

Fischer-Tropsch

Shultz, J. F., Abelson, M., Shaw, L. and Anderson, R. B. FISCHER-TROPSCH SYNTHESIS. NITRIDES AND CARBONITRIDES OF IRON AS CATALYSTS. *Ind. Eng. Chem. 49*, 2055-60 (1957) Dec.

Fused-iron catalysts, converted to nitrides and carbonitrides, were tested in the Fischer-Tropsch synthesis at 7.8 and 21.4 atm. The activity of nitrides increased with nitrogen content up to about an N/Fe atom ratio of 0.25, and at this point a major change in selectivity occurred. Nitrided catalysts oxidized more rapidly at 21.4 than at 7.8 atm, but the rate of removal of nitrogen was about the same.

Production

Swain, P. and Gibson, R. WORLD-WIDE OIL REPORT. *Oil Gas J. 55*, 121-70, 2, 4, 6, 9-80, 2, 4, 7, 90, 3 (1957) Dec. 3.

An annual report including country-by-country maps of refining and production data, with a listing of oil companies operating outside the U.S. and Canada.

Rathbone, M. J. OUR UNTAPPED OIL RESERVE—GREATER EFFICIENCY. *Independent Petrol. Assoc. Monthly 28*, 38-9, 68 (1957) Dec.

Expenditures can be reduced, thus increasing net revenues at the same price level, through improved finding and more efficient producing and development methods. Expenditures in the oil producing industry are divided between its exploration and producing functions. Each of these offers excellant opportunities for technological progress.

Secondary Recovery

Fothergill, C. A. AN IMPROVED BLOTTER MODEL FOR ANALOG STUDIES. *J. Petrol. Tech. 9*, 55-6 (1957) Dec.

An improved blotter model makes use of a plastic sheet as base for the blotter field and pins to represent the input wells. The model is simple to construct and adapt and is particularly useful for demonstration purposes. Operational data are given.

Johansen, R. T., Powell, J. P. and Dunning, H. N. DETERGENT AND CITRIC ACID CLEAN-OUT PROCEDURE. *Producers Monthly 22*, 19, 21-2, 4-6 (1957) Dec.

Extreme plugging conditions can completely stop injection into a formation. A number of accepted cleanout methods are currently practiced which are designed to flush fluid back and forth across or through the face of the wellbore. Results are reported for nonionic detergent added to the cleaning fluid.

Torrey, P. D. SIGNIFICANCE OF SECONDARY RECOVERY AND PRESSURE MAINTENANCE IN THE SOUTHWESTERN AREA. *Producers Monthly* 22, 39-50 (1957) Dec.

The results obtained from some typical fluid injection projects in the southwestern states of Texas, Arkansas, and Louisiana demonstrate how the recovery of oil is being improved or can be improved in many fields.

Solvent Troubles

Guthrie, J. A. and Hepp, P. S. EFFECT OF OIL FIELD USE OF CHLORINATED SOLVENTS ON CATALYTIC REFORMING. *Petrol. Eng. 29*, C40-4 (1957) Dec.

The type and magnitude of the troubles encountered in the use of chlorinated solvents in oil fields. The importance of careful selection of additives for oil-field use is stressed.

Static Protection

Bustin, W. M., Culbertson, T. L. and Schleckser, C. E. Jr. HOW TO CONTROL STATIC ELECTRICITY IN COMMERCIAL TANKAGE. *Oil Gas J. 55*, 89-94, 6, 8, 102 (1957) Dec. 16.

Static electricity which is generated in hydro-

carbons during normal operations occasionally causes a spark in a tank vapor space. Current safety measures include low pumping rates, avoidance of surface agitation and water, and use of floating-roof tanks to eliminate the vapor space. Tanker compartments are gas freed when necessary. Carbon dioxide gas blanketing is planned for some barge operations.

Tar-Sand Extraction

Gibbon, A. IS THIS THE ANSWER TO THE ATHABASKA TAR SAND RIDDLE? *World Oil 145,* 171-4 (1957) Dec.

Experiments carried on models of Athabaska tar sand proved conclusively the feasibility of extracting tar by in-place operations (i.e. without mining the sand) by means of a steam injection well pattern surrounding a producer from which the melted tar is recovered by flowing and/or pumping. The impossibility of recovering Athabaska tar by a single well steam injection operation has been shown.

7. ANALYTICAL METHODS AND TESTS

Gas Chromatography

Knight, H. S. GAS CHROMATOGRAPHY OF OLEFINS. DETERMINATION OF PENTENES AND HEXENES IN GASOLINE. *Anal. Chem. 30,* 9-15 (1958) Jan.

A suitable scheme is developed for determining pentenes and hexenes in unknown olefin blends by gas chromatography. Pentenes and hexenes are isolated and each fraction is separated into chain mono-olefins and cyclic olefins plus dienes. Latter are then separated by type. Fifteen C_5 olefins and 15 of 17 possible C_6 mono-olefins can be determined.

Sokolov, V. A., Andronikashvili, T. G., Kuz'mina, L. P. and Shishkova, V. P. THE USE OF CERTAIN MINERALS OF DIFFERENT ADSORPTIVE CAPACITY FOR THE CHROMATOGRAPHIC ANALYSIS OF GASES. *Khim. Tekh. Top. Masel,* 61-5 (1957) No. 10.

Experimental data indicate the advisability of using activated carbon to separate H_2, CO, and CH_4; silica gel for C_2-C_3 hydrocarbons and coarse-pored natural sorbents for C_4-C_7. Mixtures containing up to 20 components can be analyzed by the described technique.

Assoc. Tech. Services, Inc.

Tenney, H. M. SELECTIVITY OF VARIOUS LIQUID SUBSTRATES USED IN GAS CHROMATOGRAPHY. *Anal. Chem. 30,* 2-8 (1958) Jan.

In this study, 18 liquid substrates used in gas chomatography have been screened as to selectivity towards types of hydrocarbons and oxygenated compounds. Results permit comparison of retention between compound types at various boiling point levels. Dipropionitriles show the highest selectivity. Squalene is best nonselective substrate for hydrocarbons.

Gas Sampling

Ryant, C. J. Jr. and Nutt, R. V. (assigned to Standard Oil Co.) GAS SAMPLING AND TEMPERATURE MEASURING DEVICE. U.S. 2,814,952 (1957) Dec. 3.

In a thermocouple installation, the thermocouple is exposed to flowing gases so that the heat transferred to the thermocouple by conduction-convection equals the radiation heat loss. A sample of the gas corresponding to the composition existing at the point where the temperature is measured is obtained.

Infrared Spectroscopy

Smith, C. D. INFRARED SPECTROSCOPY—MOLECULAR SLEUTH. *Battelle Tech. Review 6,* 3-8 (1957) Dec.

The technical background, spectral interpretation, instrumentation, applications and future of infrared spectroscopy.

Iron in Slag

Jackson, P. J. THE DETERMINATION OF FERROUS IRON IN PULVERIZED FUEL ASH AND SLAGS FROM PULVERIZED FUEL-FIRED BOILERS. *J. Appl. Chem. 7,* 605-9 (1957) Nov.

The method of Wilson for the determination of the total ferrous content of silicate rocks has been modified so that it could be applied conveniently to samples as small as 50 mg. The ferrous content could be determined with an error not more than $\pm$ 30 μg of FeO. A study was made of the state of oxidation of the iron in pulverized fuel ash and corresponding boiler furnace slags; the dependence of the ferrous content on the total iron and carbon contents of the ash was demonstrated.

Mass Spectrometry

Weaver, E. R., Hughes, E. E., Gunther, S. M., Schuhmann, S., Refearn, N. T. and Gorden, R. Jr. INTERPRETATION OF MASS SPECTRA OF CONDENSATES FROM URBAN ATMOSPHERES. *J. Research 59,* 383-404 (1957) Dec.

In interpreting the mass spectra, if the products from each source are of substantially constant composition it is possible to obtain a representative pattern of each and to proceed thereafter to make a fairly good estimate of the character and amount of pollutants in terms of their sources. The greatest simplification is made by treating the gases associated with motor traffic as a unit.

SETTING SPEED RECORD FOR CHEMICAL ANALYSIS. *Chem. Week 81,* 81-2 (1957) Dec. 21.

A time-of-flight mass spectrometer has been developed at Bendix's Detroit research labs. The analyzer costs $15-25,000, depending on the model. It identifies gases, vaporized liquids and solids (including metals) by revealing their molecular masses.

Metals in Oil

Nagashima, K. and Machin, J. S. SPECTROCHEMICAL DETERMINATION OF COPPER, NICKEL AND VANADIUM IN CRUDE PETROLEUM. Circular 235. Urbana: Illinois State Geological Survey, 1957.

A procedure for analyzing crude petroleum for copper, nickel, and vanadium present as traces in Illinois crude petroleum. The method involves concentration of the metals in the ash from 100 g of crude oil and converting the ash to a solution in dilute hydrochloric acid. The determination is made by spectrographic means using a rotating electrode with high-voltage spark excitation.

Salts in Dusts

Gelman, C. ESTIMATION OF WATER SOLUBLE CHLORIDES, SULFATES, AND NITRATES IN SUSPENDED ATMOSPHERIC DUSTS. *J. Air Pollution Control Assoc. 7,* 216-9 (1957) Nov.

As part of a program of atmospheric dust identification it was desired to determine the amount of water soluble chlorides, sulfates, and nitrates in these dusts. Modification of sampling technique, changes in methods for chloride and sulfate determination and a method for the estimation of nitrates are given.

Sulfides in Petroleum

Hubbard, R. L., Haines, W. E. and Ball, J. S. QUANTITATIVE DETERMINATION OF ORGANIC DISULFIDES. *Anal. Chem. 30,* 91-3 (1958) Jan.

Three chemical reduction procedures and a polarographic method for determining disulfides in petroleum have been tested with 15 disulfides. Acid reflux method gave best overall recoveries but poor recovery of disulfides molecular weight. A rapid acid-stirring method can be recommended for routine work. Polarography is unsatisfactory for a wide range of disulfides.

Karchmer, J. H. DETERMINING SULFUR COMPOUNDS IN PETROLEUM NAPHTHA. THE HUMBLE SCHEME. *Anal. Chem. 30,* 80-5 (1958) Jan.

An integrated scheme for determination of mercaptans, hydrogen sulfide, elemental sulfur, aliphatic and cyclic sulfides, disulfides, thiophenes, and total sulfur in liquid petroleum samples. Flow chart shows recommended procedures, order of their applications, necessary pretreatments, possible interferences, and certain limitations. Polarographic, potentiometric, spectrophotometric, mass spectrometric, and chemical techniques are used.

Water in Gases

Garton, W. R. S., Webb, M. S. W. and Wildy, P. C. THE APPLICATION OF VACUUM ULTRA-VIOLET TECHNIQUES TO THE CONTINUOUS MONITORING OF TRACE CONCENTRATIONS OF WATER IN SEVERAL GASES. *J. Sci. Instruments 34,* 496-500 (1957) Dec.

Absorption bands of the water molecules in the 1200 A region are used for the determination of water in several gases. A 20 megacycle/sec electrodeless discharge in hydrogen excites the 1216 A Lyman α line very strongly and relatively free from neighboring lines and bands. The radiation passes through the absorption cell, closed at both ends by lithium fluoride windows, to the tungsten cathode of a photomultiplier which is insensitive to light of wavelength longer than 1400 A.

8. GENERAL AND PHYSICAL CHEMISTRY

Adsorption

Bobka, R. J., Dininny, R. E., Siebert, A. R. and Pace, E. L. HEAT CAPACITY AND HEAT OF ADSORPTION OF ARGON ADSORBED ON GRAPHON. *J. Phys. Chem. 61,* 1646-8 (1957) Dec.

Heat capacities of argon adsorbed on *Graphon* were determined calorimetrically in the range of 55°-88° K, for surface coverages of 0.301, 0.609 and 0.921 fractions of a monolayer. The data indicate the existence of maxima at temperatures below 55°K, with the height of each maximum increasing as coverage decreases. The general shape of the curve agrees with other studies of the system and, in particular, confirms the presence of a maximum isosteric heat of adsorption at about 0.75 fraction of a monolayer. This maximum is interpreted as being due to a prominence of argon-argon interactions on a relatively homogeneous surface.

Pace, E. L. ARGON ADSORBED ON A GRAPHITIC SURFACE. THE HEAT OF ADSORPTION FROM LATTICE LIQUID THEORY. *J. Chem. Phys. 27,* 1341-6 (1957) Dec.

A model to account for the differential or isosteric heat of adsorption which has been observed for argon on *Graphon* at concentrations between 0.5-2.0 monolayers for temperatures in the neighborhood of the normal boiling point of argon. The energy of a molecule on the surface is considered to be the sum of two contributions: 1) a site energy for the isolated molecule and 2) an interaction energy with neighbors in the same layer.

Atomic Oxygen

Ford, H. W. and Endow, N. RATE CONSTANTS AT LOW CONCENTRATIONS. Part 4. REACTIONS OF ATOMIC OXYGEN WITH VARIOUS HYDROCARBONS. *J. Chem. Phys. 27,* 1277-9 (1957) Dec.

Nitrogen dioxide was photolyzed at trace concentrations in a carrier gas at a pressure of one atm. The concentration of atomic oxygen could be estimated by using rate constants previously obtained. An iterative method was used to calculate the concentration of atomic oxygen in the presence of trace amounts of hydrocarbons.

Catalysts

Sternberg, H. W., Markby, R. and Wender, I. BINUCLEAR IRON CARBONYLS AND THEIR SIGNIFICANCE AS CATALYTIC INTERMEDIATES. *J. Amer. Chem. Soc. 79,* 6116-21 (1957) Dec. 5.

Evidence for the existence of binuclear iron carbonyl ions $[H_2Fe_2(CO)_8]^=$ formed by the dimerization of two $[HFe(CO)_4]^-$ ions. The chemical and catalytic properties of solutions obtained by treating $Fe(CO)_5$ with aqueous alkali can be explained on the basis of the existence of these two compounds. Previous explanations, which took into account only the existence of the mononuclear ions, are not in agreement with experimental facts.

Compressibility

Zimmerman, R. H., Beitler, S. R. and Darrow, R. G. METHOD FOR PREDICTING SUPERCOMPRESSIBILITY FACTORS FOR NATURAL GAS. *Gas Age 120,* 38-41 (1957) Dec. 12.

A working method for the accurate prediction of these factors, within the pressure range of 0-3000 psi and in terms of gas properties generally known or conveniently determined. This method is the basis upon which the American Gas Association Supercompressibility Tables have been developed.

Dielectric Properties

Boggs, J. E., Thompson, C. M. and Crain, C. M. THE DIELECTRIC CONSTANT OF GASES IN THE REGION OF ROTATIONAL ABSORPTION FREQUENCIES. *J. Phys. Chem. 61,* 1625-7 (1957) Dec.

The dielectric constants of cyanocetylene, H—C≡C—CN, and *t*-butyl iodide $(CH_3)_3CI$, have been determined in the gas phase at 42°C in the frequency region between 8850-9500 megacycles. Although these compounds have their first and third rotational transitions, respectively, within this range, no resonance disperson was observed. The dielectric constants of CH_3Cl and CH_3CCl, which have been shown to be below the reported static values at 9400 megacycles, decrease very gradually throughout the frequency range studied.

Film Permeability

Crowe, C. M. THE THERMO-OSMOSIS OF GASES THROUGH POLYMERS. *Trans. Faraday Soc. 53,* 1413-22 (1957) Nov.

The thermo-osmosis of a gas through a polymer membrane, in which it dissolves, occurs if a temperature gradient is imposed across the membrane. The derivation is presented of equations for the gradual change of the pressure difference across the film towards an eventual steady state. They extend to variable and unequal volumes of gas on the two sides of the membrane. It is shown theoretically, and experiments on H_2 + rubber confirm, that the substitution of variable for constant volume reservoirs has much greater effect on the time than expected from the fractional change in volume.

Gas Viscosities

Ross, J. F. and Brown, G. M. VISCOSITIES OF GASES AT HIGH PRESSURES. *Ind. Eng. Chem. 49,* 2026-33 (1957) Dec.

A new type of pressure viscometer to measure the viscosities of methane, nitrogen, and helium from 25° to -50° C, at 500-10,000 psig. These data and the most reliable data of other investigators are used to extend a generalized correlation for predicting the effect of pressure on gas viscosity.

Hydrocarbon Properties

Hobson, M. and Weber, J. H. THERMODYNAMIC PROPERTIES OF PURE AND MIXED HYDROCARBONS. Part 1. LATENT HEATS OF VAPORIZATION FOR PURE HYDROCARBONS. *Petrol. Processing 12,* 43-7 (1957) Aug.; Part 2. LATENT HEATS OF VAPORIZATION FOR HYDROCARBON MIXTURES. *Ibid.* 153-7 Sept.; Part 3. PURE SUBSTANCE ENTHALPY AND ENTROPY. *Chem. Eng. 64,* 245-50 (1957) Nov.; Part 4. ENTHALPY AND ENTROPY DATA FOR HYDROCARBON MIXTURES. *Ibid.* 272-4 Dec.

Methods for determining the latent heats of vaporization of a pure compound originate in the Clapeyron equation. Procedures are shown for a direct solution from a minimum amount of data and an improved method is suggested. The isobaric integral, the isothermal integral and the differential latent heats of vaporization of mixtures of compounds are explained and defined. Their application is explained in the calculations of their thermodynamic relationships to enthalpy, volumetric and equilibrium data. The physical data required to derive the thermodynamic properties of enthalpy and entropy for mixtures and compounds are considered. Rigorous and generalized methods are given by which they are determined.

Phase Equilibria

Braun, C. F. VAPOR-LIQUID—EQUILIBRIUM DATA FOR THE TERNARY SYSTEM CYCLOHEXANE-HEPTANE-TOLUENE. *A. I. Ch. E. J. 3,* 467-72 (1957) Dec.

Previous papers have reported equilibrium data for the binary systems cyclohexane-heptane, heptane-toluene, and cyclohexane-heptane-toluene. This study gives similar data for the ternary system cyclohexane-heptane-toluene and compares the activity coefficients with those predicted from three limiting binaries. The ternary activity coefficients fall well in line between the limiting-binary data. Distribution is about as would be predicted by the ternary Margules equations. As an approximation, if the coefficients are plotted as a function of the aromatic concentration only, without consideration of the ratio of naphthenes to paraffins, reasonably good correlation is observed.

PVT Measurements

Luft, L. CONSTANT PRESSURE METHOD FOR DETERMINING PVT RELATIONS OF GASES. *Ind. Eng. Chem. 49,* 2035-9 (1957) Dec.

The method is based on determination of volume change of a system on injection of a known mass of gas, at constant temperature and essentially constant pressure. A pilot apparatus was built to test its technical feasibility, and an isotherm was obtained to 300°C and up to 100 atm pressure, using nitrogen as the test gas.

Price, D. and Lalos, G. T. ADIABATIC COMPRESSOR FOR DYNAMIC PVT MEASUREMENTS ON GASES TO 100,000 PSI. *Ind. Eng. Chem. 49,* 1987-92 (1957) Dec.

To study gases at simultaneously high temperatures and pressures, an adiabatic compressor was designed to compress gases to about 100,000 psi and 4000°K in 25 milliseconds. The

compressor has an inside diameter of three inches, a stroke length of 21 in., and a 17-lb, gas-driven piston. It is instrumented for PVT measurements and for a response time fast enough to follow extreme conditions, which last only 20μ sec.

Radiation Chemistry

Melville, H. W. THE USE OF RADIOACTIVE ISOTOPES AND HIGH-ENERGY RADIATION IN POLYMER CHEMISTRY. *Chem. & Ind.*, 1632-41 (1957) Dec. 21.

This Fourth Tennant Memorial Lecture deals with carbon, halogens and other radioisotopes and their use as tracers with several examples of polymerization. High energy radiation and its effect in speeding up organic reactions is treated similarly.

Thermal Conductivity

Johannin, P. and Vodar, B. THERMAL CONDUCTIVITY OF NITROGEN AT HIGH TEMPERATURES AND PRESSUES. *Ind. Eng. Chem. 49*, 2040-1 (1957) Dec.

An apparatus was developed using a cylindrical thermoconductivity cell in a water-cooled high-pressure vessel with internal heating. Results have been obtained for nitrogen up to 1300 atm and 300°C.

Leng, D. E. and Comings, E. W. THERMAL CONDUCTIVITY OF PROPANE. *Ind. Eng. Chem. 49*, 2042-5 (1957) Dec.

Pressure-thermal conductivity isotherms were determined for propane up to 280 atm at temperatures of 122°-284°F. A concentric gas layer type of cell was used, which gave a precision within 3%. The unexpected behavior of the thermal conductivity of propane is discussed and possible explanations are offered. A correlation based on molecular complexity is proposed.

Owens, E. J. and Thodos, G. THERMAL-CONDUCTIVITY — REDUCED-STATE CORRELATION FOR THE INERT GASES. *A. I. Ch. E. 3*, 454-61 (1957) Dec.

The fragmentary thermal-conductivity data for argon have been correlated by use of a residual thermal conductivity $k - k^*$ vs. density ρ relationship. This correlation produced a unique continuous curve which was found to be singularly independent of temperature and pressure for both gaseous- and liquid-state data. From low-pressure thermal-conductivity values k^* and the relationship given above, it is possible to determine thermal conductivities at any condition of temperature and pressure for which a corresponding density is available. In a similar manner the critical thermal conductivity k_C for argon was established directly from the critical density and the quantity k_{Tc}^*. The k_C value permitted the calculation of reduced thermal conductivities k_R and made possible the construction of an extensive reduced-state chart. The chart was also found applicable to the diatomic gases and their mixtures but produced significant deviations for substances having more than two atoms per molecule.

Powell, R. W. EXPERIMENTS USING A SIMPLE THERMAL COMPARATOR FOR MEASUREMENT OF THERMAL CONDUCTIVITY, SURFACE ROUGHNESS AND THICKNESS OF FOILS OR OF SURFACE DEPOSITS. *J. Sci. Instruments 34*, 485-92 (1957) Dec.

The thermal comparator described consists of two metal balls similarly mounted in a block of balsa wood. One ball is mounted at a slightly lower level so that it touches any surface on which the block rests. After heating to a small fixed temperature excess, the block is put in contact with the test surface. Differentially connected thermocouples attached to each ball measure the increased rate of cooling of the ball which makes contact. The differential emf observed 10 sec after contact, is shown to be a function of the thermal conductivity of the material on which the ball rests. When calibrated in terms of at least two substances of known thermal conductivity, determinations of thermal conductivity can be quickly obtained.

9. ORGANIC CHEMISTRY AND PETROCHEMICALS

Acetylene

Koble, R. A. (assigned to Phillips Petroleum Co.) RECOVERY OF ACETYLENE FROM GASES CONTAINING IT IN SMALL PROPORTION. U.S. 2,814,359 (1957) Nov. 26.

Acetylene in small quantities in gas is recovered by scrubbing with a selective solvent, methyl formamide, then flashing off the product from the solvent in a treating zone.

MORE ACETYLENE-ETHYLENE. *Petrol. Week 5*, 43-4 (1957) Dec. 20; *Chem Eng. News 35*, 32 (1957) Dec. 23.

Tennessee Eastman Co. announces a new process for making acetylene or ethylene by high temperature cracking of hydrocarbons in hot combustion gases from natural gas with 95% theoretical oxygen followed by direct water quenching.

Butadiene Production

Reidel, J. C. MAKING BUTADIENE. Part 1. WHAT'S HAPPENED TO BUTADIENE SINCE PRIVATE INDUSTRY TOOK OVER. *Oil Gas J. 55*, 166-7, 70-1 (1957) Nov. 11; Part 2. BUTYLENE DEHYDROGENATION BY THE STEAM-DILUTION METHOD. *Ibid.* 87-8, 90, 3, 5 Dec. 2; Part 3. BUTANE DEHYDROGENATION TODAY EMPLOYS FIXED-BED METHODS. *Ibid.* 114-5, 7-9, 21, 22 Dec. 9. Part 4. FEED PREPARATION AND FINISHING BY ACETONE OR ACETONITRILE AND CAA. *Ibid.* 110, 4, 6, 8, 20, 3 Dec. 16; Part 5. FEED PREPARATION AND FINISHING BY FURFURAL EXTRACTIVE DISTILLATION. *Ibid.* 74-80 Dec. 23.

Today's best method for commercial production of butadiene from butylenes, the progress since the government sold the plants, current expansion, trends, uses, and future outlook are discussed. Part 2 describes the great activity in catalyst development using silica-alumina and Shell 105 and 255 catalysts. The tie-in between the steam-dilution method (butylene dehydrogenation) and the Houdry adiabatic or Phillips isothermal butane dehydrogenation is explained in Part 3. Part 4 discusses acetone or acetonitrile extractive distillation for the feed preparation, and extraction with cuprous ammonium acetate for butadiene recovery. Part 5 reviews the use of furfural extractive distillation when butylene or butane is the feed. The commercial C_4-separation processes are summarized. The use of UV and IR analyzers-controllers in furfural processing is covered.

OPERATIONS UNDERWAY AT SYNTHETIC RUBBER PLANT. *Petrol. Eng. 29*, C7-10 (1957) Dec.

Manufacturing processes for the first privately financed, totally integrated synthetic rubber complex using butane as a raw material. Plants are Odessa Butadiene Co., Odessa Styrene Co., and General Tire and Rubber Co.

Ethylene Hydrolysis

Muller, J. and Waterman, H. I. DIE HYDRATATION VON AETHEN UND PROPEN (THE HYDROLYSIS OF ETHYLENE AND PROPYLENE). *Brennstoff-Chemie 38*, 321-9 (1957) Nov. 13.

The influence of reaction conditions were investigated in the addition of water to ethylene using a silicotungstic acid catalyst on silica gel. Temperatures were between 200°-290° C, pressures between 10-50 atm, molar proportions for ethylene/H_2O between 0.5-6.5, space velocities between 3,000-12,500 l gas/ l catalyst per hr, and percentage ethylene in recirculated gas between 98-20%, while balancing with nitrogen. Experimental conversion was compared with calculated. Silicotungstic salts of Co, Fe, Cu and Cr were tested for activity, the latter two comparing favorably with the acid.

Phenol Recovery

Geller, J. and Ratte, H. (assigned to Rutgerswerke-A. G., Germany) DISTILLATION OF PHENOL FROM AQUEOUS PHENOLATES. U.S. 2,815,389 (1957) Dec. 3.

Phenol vapors from a phenol distillation column are used to heat the phenol-bearing "sprung" soda solution in the base of the dephenolation column. Phenol vapors from this dephenolation column are condensed, part of the condensate returned as reflux in the column and the dilute part returned to the CO_2 saturating tower.

Naphthalene Purification

Woolhouse, T. G. THE MANUFACTURE OF NAPHTHALENE OF CRYSTALLIZING POINT 78°F. *J. Appl. Chem. 7*, 573-83 (1957) Nov.

Direct fractionation of the naphthalene oil fraction from a Wilton continuous still achieved some success, but the yield was reduced by the presence of as little as 1% of tar acids. Crystallization and water-washing on the centrifuge were selected for the final upgrading to a crystallization point of 78°F.

10. CHEMICAL ENGINEERING

CO_2-NH_3 Separation

Marullo, G. and Mazzetti, R. (assigned to Montecatini, Soc. Gen. l'Industria Mineraria e Chimica, Italy) PROCESS FOR SEPARATING CARBON DIOXIDE AND AMMONIA. U.S. 2,812,829 (1957) Nov. 12.

From a carbon dioxide-ammonia mixture under pressure, ammonia is absorbed selectively by a concentrated aqueous solution of ammonium nitrate, which flows to a flash-tank and loses dissolved ammonia and is cooled by reduction of pressure. The cooled solution is passed back to an indirect heat exchanger in the top of the absorber tower, where absorption heat drives off more ammonia, and finally is stripped of ammonia in a steamed column and recycled. (See *Gas Abstracts 13*, 303.)

Gas Compressor

Wolf, R. C. and Bowen, J. C. COMPRESSING OF GASES IN THE PURE STATE TO HIGH PRESSURES. *Ind. Eng. Chem. 49*, 1962-4 (1957) Dec.

For compressing gases to high pressures without contamination, the method of hydraulically moving a thin metallic diaphragm to displace the gas was selected. The final unit had higher volumetric efficiencies than conventional compressors, added safety (due to no contaminants and reduced temperature buildup), and ability to compress gases of low molecular weight or toxic gases without appreciable leakage.

Gas Flow

Koga, T. A METHOD FOR SOLVING PROBLEMS OF IRROTATIONAL GAS FLOW BY MEANS OF HIGH-SPEED DIGITAL COMPUTERS. *J. Applied Mech. 24*, 497-500 (1957) Dec.

A numerical procedure for solution of certain problems in steady gas flow where subsonic, sonic, and supersonic regions appear simultaneously. Given a streamline and the state of the gas along that streamline, the coordinates of the neighboring streamline and the state of the gas along it can be computed. The procedure can be applied successively to cover a flow field. The method is described in detail for two-dimensional, steady, irrotational flow (without shocks) of a perfect gas, and an example is given.

Heat Exchangers

Young, E. H. and Ward, D. J. HOW TO DESIGN FINNED TUBE SHELL AND TUBE HEAT EXCHANGERS. *Petrol. Eng. 29*, C18-24 (1957) Dec.

Design relationships, including liquid-liquid cooler sample problems. Economics of finned tube exchangers.

High Pressure Practise

Birch, F., Robertson, E. C. and Clark, S. P. Jr. APPARATUS FOR PRESSURES OF 27,000 BARS AND TEMPERATURES OF 1400°C. *Ind. Eng. Chem. 49*, 1965-6 (1957) Dec.

An apparatus constructed for the study of phase equilibria in geologically important systems at high temperatures and pressures is an enlarged version of Bridgman's 30,000-bar apparatus with an electrically heated furnace inside the pressured vessel. Pressure and temperature are measured with the aid of additional electrical circuits let into the high-pressure region. The fields of stability of several minerals which are not stable at one atm have been determined.

Bowen, J. C. and Jenkins, R. L. SAFETY AT HIGH PRESSURES. FEATURES OF AN EIGHT-CUBICLE LABORATORY. *Ind. Eng. Chem. 49*, 2019-21 (1957) Dec.

This new laboratory provides protection to personnel and surrounding area beyond present requirements. Safeguards and safe-to-operate checks are incorporated throughout; controls, instruments, and valves are conveniently grouped. Equipment can be shifted for greater utility and major changes can be made by built-in expansion facilities.

Kiefer, R. W. SAFETY AT HIGH PRESSURES. *Ind. Eng. Chem. 49*, 2017-8 (1957) Dec.

The mechanical factor in safe practices, covering connections, gages, check valves, rupture disks, and barricading. Four explosions of high pressure vessels and resulting damage together with the barricade resulting from experience with these explosions is described.

Stephens, H. R. and Walker, K. E. SAFETY IN SMALL-SCALE HIGH PRESSURE EXPERIMENTS. *Ind. Eng. Chem. 49*, 2022-5 (1957) Dec.

Practices related to operating procedures and

equipment, developed during many years' work with new reactions in shaker tubes. These practices have made it possible to complete 50,000 experiments, about 80 man-years of work, with only one lost-time accident.

Ion Exchange

McGarvey, F. X. ION EXCHANGE AS A UNIT OPERATION. *Chem. Eng. 64,* 255-60 (1957) Dec.

Separation problems are best tackled via pilot-plant data. Background data for sizing up ion exchange operations are given: what it can do, what it costs, and how it compares.

Low Temperature Separation

ADVANCES IN LOW-TEMPERATURE GAS SEPARATION IN INDUSTRY. *Chem. & Process Eng. 38,* 476-8 (1957) Dec.

A symposium organized jointly by the Institution of Chemical Engineers and the Low Temperature Group in London on Nov. 26 reports on the interest in capital and operating costs with respect to reduced power consumption, heat exchange in oxygen plants, demethanizers in ethylene plants, stability of ethylene plant operation, design for oxygen purity, hydrogen purification, and computers in design work.

Operating Labor

Wobus, R. S. ESTIMATION OF DIRECT OPERATING LABOR REQUIREMENTS FOR NEW MANUFACTURING PROCESSES. *Chem. Eng. Progress 53,* 581-5 (1957) Dec.

An account of the simplified methods in current use in various organizations.

Reactor Heating

Vernon, L. N. and Sliepcevich, C. M. HEAT TRANSFER IN A HIGH PRESSURE REACTOR. *Ind. Eng. Chem. 49,* 1945-8 (1957) Dec.

Heat transfer and fluid flow were studied in a new type of high-pressure tubular reactor, which utilizes a machined helix between the liner and body for passage of a heating or cooling fluid. Overall heat-transfer coefficients based on the inside area of the reactor were as high as 540 Btu/(hr) (sq ft) (°F) for condensation of steam by water. Pressure drop data indicate that in laminar flow, the friction factor for the coil can be calculated by Prandtl's equation for coiled pipe.

Sorption Processes

Monet, G. P. SORPTION PROCESSES. ADSORPTION, DIALYSIS AND ION EXCHANGE—AN INTRODUCTION. *Chem. Eng. Progress 53,* 514-7 (1957) Nov.

This introduction to the series listed below under *Lapidus, L., Selke, W. A.* and *Winger, A. G.,* relates adsorption, dialysis and ion exchange as "sorption processes" and lists developments in this field since 1945.

Lapidus, L. SORPTION PROCESSES. GRANULAR PROCESSES — ADSORPTION. *Chem. Eng. Progress 53,* 517-9 (1957) Nov.

Most of basic research in this field has dealt with sorption of gases, which includes physical adsorption, chemisorption, filtration through microporous materials, and more recently, the use of molecular sieves.

Selke, W. A. SORPTION PROCESSES. GRANULAR PROCESSES—ION EXCHANGE. *Chem. Eng. Progress 53,* 601-5 (1957) Dec.

Results of research and development on ion exchange, of value in the study of other sorption processes. The mechanical techniques for continuous contacting of fluids and solids are discussed, with applications of the mathematics of fixed bed ion exchange.

Winger, A. G. SORPTION PROCESSES. MEMBRANE PROCESSES—ION EXCHANGE. *Chem. Eng. Progress 53,* 606-12 (1957) Dec.

Research since 1947 has concentrated on a study of the mechanisms whose additive effects determine the rate of mass transfer across membranes—adsorption and desorption, diffusion down a concentration, an electric potential or a hydraulic pressure gradient, electroosmosis—as well as on selectivity characteristics of the membranes. One or more of the listed mechanisms are involved in each of the successful applications of membranes to commercial operations.

Suspension Flow

Happel, J. and Brenner, H. VISCOUS FLOW IN MULTIPARTICLE SYSTEMS: MOTION OF SPHERES AND A FLUID IN A CYLINDRICAL TUBE. *A. I. Ch. E. J. 3,* 506-13 (1957) Dec.

An approximate theory for the behavior of multiparticle systems suspended in a viscous fluid

is developed, based on a rigorous treatment of the case for a single sphere occupying any position in a cylindrical tube. The results obtained include estimates of the effect of some of the parameters involved on the particle velocities and spatial distribution of particles in very dilute sedimenting and fluidized beds as well as on the pressure drop resulting from passage of fluid.

Thermal Flowmeter

Doyle,, R. T. METERING GAS WITH A HEATED THERMOPILE. *Instruments & Automation 30,* 2276-8 (1957) Dec.

This gas flow indicator, based on the heated thermopile, is safe for explosive atmospheres.

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Calorimetry

Glaser, P. E. HIGH RADIATION-FLUX, ABSOLUTE, WATER-FLOW CALORIMETER. *Rev. of Sci. Instruments 28,* 1084-6 (1957) Dec.

A high radiation-flux, measuring calorimeter has been designed for use in imaging furnaces. It consists of a black-body receiver provided with a cooled aperture and cylindrical housing. It can be exposed to flux densities of the order of 400 cal/cm² sec for extended periods without deterioration. Thermopiles measure the temperatures of the inlet and outlet cooling water. Heat losses are virtually eliminated, and the measurement of a wide range of heat fluxes is permitted. Probable error in the radiation-flux measurement is within five per cent.

Raymond, W. F., Canaway, R. J. and Harris, C. E. AN AUTOMATIC ADIABATIC BOMB CALORIMETER. *J. Sci. Instruments 34,* 501-3 (1957) Dec.

The conversion of an existing isothermal bomb calorimeter to one with automatic adiabatic control using thermistors is detailed. The equipment is more rapid and less tedious for routine use. Determinations of heat content take approximately 30 min; the coefficient of variation of a single determination, with an average temperature rise of 1.9° C, is 0.34%.

West, E. D., and Ginnings, D. C. AUTOMATIC TEMPERATURE REGULATION AND RECORDING IN PRECISION ADIABATIC CALORIMETRY. *Rev. of Sci. Instruments 28,* 1070-4 (1957) Dec.

One-man calorimeter operation is possible when temperature differences are recorded and controlled automatically and integrated with respect to time. Automatic control of adiabatic jackets, when the calorimeter is intermittently heated, is achieved by the application of electronic instrumentation to the control and evaluation of heat exchange. This method permits one operator to measure heat capacities from 30°-500° C with an accuracy of 0.1%.

Computer

DECISIVE BREAKTHROUGH IN COMPUTER ECONOMICS. *Research & Engineering 3,* 14-6 (1957) Nov./Dec.

Capabilities of large-scale systems at half the price are now offered by a digital computing system with full magnetic core memory. Average cost will range from $325,000-600,000.

Gasket

House, H. W. (assigned to National Clay Pipe Manufacturers, Inc.) PIPE JOINT AND INFLATABLE GASKET THEREFOR. U.S. 2,815,966 (1957) Dec. 10.

An inflatable gasket for bell and spigot pipe joints comprises an annular elastic tube with its outer annular wall (bell-side) thicker than the other. The interior surfaces temporarily collapse and are secured by adhesive which separates when grout is injected through an inlet nipple.

Gas Turbine Power

Apitz, C. R. ECONOMICS OF GAS TURBINE DRIVERS IN THE REFINERY. *Petrol. Eng. 29,* C11-4 (1957) Dec.

An analysis of gas turbine applications and operating characteristics for pump and compressor drives, power generation, and emergency use.

High Pressure Pumps

Bleyle, G. A. Jr., Crosby, H. W. and Kendall, R. E. LIQUID NITROGEN PUMP AND VAPORIZER. LABORATORY SIZE OPERATED AT 10,000 PSI. *Ind. Eng. Chem. 49,* 1955-8 (1957) Dec.

To satisfy a need for dry, oil-free gaseous nitrogen at pressures up to 10,000 psi, the de-

velopment of an unlubricated liquid nitrogen pump and vaporizer system was undertaken. Of several possible systems, a reciprocating piston design, using unlubricated packing at -320°F, was selected. The pump was operated with several different types of packing and one chosen which permitted continuous operation at the design pressure.

Frederick, D. D. and Porter, R. L. A HIGH PRESSURE AIR-DRIVEN PUMP. *Ind. Eng. Chem. 49,* 1959-61 (1957) Dec.
The design and performance of an air-driven pump made for operation at 60,000 psi. Safety was the major factor in selecting a drive mechanism, but air drive was chosen for two other reasons—air pressure of only about 94 lb is needed for an output pressure of 50,000 lb; also, length of stroke and speed of operation can be easily changed without complicated and costly control devices.

Seismic Recordings

McManic, L. B. MAGNETIC RECORDING IS OPENING UP NEW FIELDS IN INSTRUMENTATION FOR SEISMIC PROSPECTING. *Oil Gas J. 55,* 116-8 (1958) Jan. 6.
Probably the most valuable use of magnetic recording is that raw seismic data can be stored in permanent form. As new filtering, record analysis, and presentation methods are developed they can be applied immediately to old records without reshooting. Seismic recorders, principles, tape handling, instrument performance and ruggedness, and record interpretation are treated.

12. MATERIALS OF CONSTRUCTION, AND CORROSION

Coatings

Kiernan, F. J. USE OF COAL TAR COATINGS FOR UNDERGROUND CORROSION MITIGATION. *Pipe Line News 29,* 58, 60, 2, 4-7 (1957) Dec.
One million miles of various underground pipe facilities valued at $14 billion are subject to corrosion. Hot-and cold- applied coal tar coatings are reviewed with respect to protective value.

Coatings

Reed, P. POLYETHYLENE TAPE FOR PIPELINE PROTECTION. *Oil Gas J. 55,* 223-4, 7 (1957) Dec. 30.
Taping operations and work involved in crossing a thick network of pipelines in producing areas are the principal features of a new construction project. The section consists of 80 miles of 20-in. from Bridgeport, Texas to Healdton, Okla.

PROTECTION ACHIEVEMENT AT MANVERS MAIN COLLIERY. *Corrosion Tech. 4,* 420-2 (1957) Dec.
A four-coat painting system (a red lead primer, a coat of aluminum, and two coats of chlorinated rubber) was developed for metal protection in the auxiliary equipment of 78 new coke ovens.

TOUGH NEW COATING. *Oil Gas J. 55,* 70-2 (1957) Dec. 16.
A new sprayed-on coating for protecting the exterior of pipelines sets faster, bonds tighter, and is tougher than most conventional pipeline coatings. Because of this, the coating is not damaged by ordinary handling, hauling, bending, and laying operations.

Engine Wear

Floyd, C. M. A FIELD STUDY OF GAS ENGINE LUBRICANTS. *J. Am. Soc. Lubrication Eng. 13,* 647-50 (1957) Dec.
The results of field tests of several years duration on the use of gas engine lubricants, of both naphthenic and paraffinic base stocks, in detergent and nondetergent formulations. These tests were made in both two-cycle and four-cycle gas engines. Effects of these oils on engine wear and engine cleanliness were evaluated.

H_2S Corrosion

Tseitlin, Kh. L., Merzloukhova, L. V. and Strunkin, V. A. CORROSION OF METALS BY HYDROGEN SULFIDE AT HIGH TEMPERATURES. *Zhurnal Prikladnoi Khimii 30,* 1553-8 (1957).
Effects of temperature, moisture and N_2 content on Al, carbon steel, copper, cast iron, CR-Al alloys are determined.

Assoc. Tech. Services, Inc.

Inhibitors

Mason, D. M., Taylor, L. L. and Rittenhouse, J. B. INHIBITING EFFECT OF HYDROFLUORIC ACID IN FUMING NITRIC ACID ON LIQUID AND GAS PHASE CORROSION OF SEVERAL METALS. *Corrosion 13,* 82lt-7 (1957) Dec.
Measurements were made at 130°F of the ex-

tent of corrosion of several metals exposed to the liquid and the gas phase of thermally stable nitric acid containing 11-13% nitrogen dioxide and 2-4% water with and without hydrofluoric acid added as a corrosion inhibitor.

Kleiner, W. B., Carmichael, G. N. and de Ganahl, C. PLASTIC PIPE AND METHOD OF MAKING SAME. U. S. 2,815,043 (1957) Dec. 3.

On a mandrel wrapped with inert, nonadhesive tape for a separating medium, plastic pipe is formed by first wrapping helically with a polyvinyl plastic tape, wrapping this with glass-fiber tape impregnated with uncured thermosetting resin, preferably epoxy resins, and applying an outer layer. The whole pipe is then cured to a fused-walled impervious mass by heated molds.

Pipe Welding

FM. 9 Comm., British Welding Research Assoc. INVESTIGATIONS INTO THE STRESS-CORROSION CRACKING IN WELDED GAS PLANT. Commun. 517, London: Inst. Gas Eng., 1957; *Gas J. 292,* 464-5, 8-70 (1957) Nov. 27; *Gas World 146,* 978 (1957) Nov. 23; *Gas Times 41,* 800-9 (1957) Dec.

Recent work has shown that stress-corrosion cracking can be produced by synthetic solutions of a type present in gas works liquors. All solutions which gave intergranular attack contained NH_3 and HCN together with either CO_2 or H_2S or both. A survey of 67 plants showed that cracking of welded mild steel components can occur anywhere up to the ammonia scrubbers. Mild stress-relieving (Linde process) applied on site has been established as preventing stress-corrosion cracking.

Reed, P. AUTOMATION SCORES IN DOUBLE JOINTING. NEW TECHNIQUE FOR INSIDE AND OUTSIDE WELDING. *Oil Gas J. 55,* 82-4 (1957) Dec. 16.

A new type of unit has been built to take advantage of the utmost in automation which can be applied in handling, rotation, and welding of pipe during double-jointing operations. Its production rate on 30-in. diam. pipe is 10-12 welds/hr.

IMPROVED AUTOMATIC MACHINE FOR WELDING ALUMINUM DEMONSTRATED. *Gas Age 120,* 47, 62 (1957) Dec. 12.

An improved automatic machine for welding aluminum, described as the first field-proved to be fully operational for pipeline construction, has been demonstrated in Venezuela. During the operational test the new machine welded 2,880 ft of the pipe in a four-hour period, with no supplemental hand welding needed at any point. This was an average of 18 satisfactory welds every hour.

13. NEW BOOKS

(C. A. Simms, Librarian)

Automation Theory

Murphy, G. J. BASIC AUTOMATIC CONTROL THEORY. New York: D. Van Nostrand Co., Inc., 1957.

The lecture notes of an engineering and physics course given at the University of Minnesota to seniors and graduate students have been arranged to present the basic theory pertinent to the analysis and synthesis of linear control systems having only fixed, lumped parameters and subject to input commands and disturbances which can be specified with certainty. The material is presented in a logical order and problems have been carefully selected to supplement the text.

Flame Spectroscopy

Gaydon, A. G. THE SPECTROSCOPY OF FLAMES. New York: John Wiley & Sons, Inc., 1957.

New experimental techniques, accumulated from 1947-54, for controlling flames for producing spectra and the results obtained by them. Chapters are included on theory of spectra, H, and CO flames, organic flames, temperature measurements, infrared region, flame structure, explosions and industrial flames, flames of nitrogen, halogens and sulfur, flame spectrophotometry, with citation of 464 references.

Texas Recovery Projects

Railroad Commission of Texas, A SURVEY OF SECONDARY RECOVERY AND PRESSURE MAINTENANCE OPERATIONS IN TEXAS TO 1956. Oklahoma City: Interstate Oil. Compact Commission, 1957.

In this third survey, tabulated data on recovery and pressure maintenance are presented for 194 new projects, and on 436 supplements to older projects.

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English translations of Russian articles abstracted herein can be supplied by arrangement with the abstractor.

Publications Abstracted for GAS ABSTRACTS

Air Conditioning, Heating and Ventilating
Air Pollution Control Association, Journal of
American Chemical Society, Journal of
American Gas Association Monthly
American Gas Journal
American Institute of Chemical Engineers, Journal of
American Petroleum Institute Quarterly
American Society for Testing Materials Bulletin
American Society of Mechanical Engineers, Transactions of
Analytical Chemistry
Appliance Manufacturer
Applied Mechanics, Journal of
Applied Mechanics Review
Applied Physics
Applied Spectroscopy
Australian Journal of *Applied Science*
Australian Journal of *Chemistry*

Battelle Technical Review
Bituminous Coal Research
Brennstoff-Chemie (German)
British Coal Utilization Research Association Monthly Bulletin and *Quarterly Gazette*
Butane-Propane News

California Oil World
Canadian Chemical Processing
Canadian Gas Journal
Canadian Journal of *Chemical Engineering*
Canadian Journal of *Physics*
Ceramics (British)
Chemical and *Engineering News*
Chemical & Process Engineering
Chemical Education, Journal of
Chemical Engineering
Chemical Engineering Progress
Chemical Engineering Science
Chemical Processing
Chemical Physics, Journal of
Coal Utilization
Control Engineering
Corrosion
Corrosion Technology (British)
Cost Engineering

Drilling

Electronics
Engineers' Digest (British)
Erdöl und Kohle

Faraday Society, Transactions of (British)
Fuel (British)
Fuel Efficiency (British)
Fueloil & Oil Heat

Gas
Gas Age
Gas & Oil Power (British)
Gas Council Research Communications (British)
Gas Heat and Comfort Cooling
Gas Journal (British)
Gas Times (British)
Gas- und Wasserfach (German)
Gas World (British)
Gasovaya Promyshlennost (Russian)

Heating, Piping & Air Conditioning

Independent Petroleum Association of America *Monthly*
Industrial and *Engineering Chemistry*
Industrial Finishing (British)
Industrial Gas (American)
Industrial Gas (British)
Industrial Heating
Industrial Laboratories
Industrial Science
Institute of Fuel, Journal of (British)
Institute of Gas Technology Research Bulletins
Institute of Petroleum, Journal of (British)
Institution of Gas Engineers Bulletins and *Communications* (British)
Instrumentation
Instruments and Automation
Izvestiya Akademii Nauk S. S. S. R. Otdelenie Khimicheskikh Nauk (Russian)

Jet Propulsion

Khimiya i Tekhnologiya. Topliva i Masel (Russian)

Laboratory Practice (British)
LP-Gas
Lubrication
Lubrication Engineer

Materials in Design Engineering
Mathematical Tables and Other *Aids* to Computation
Mechanical Engineering
Metal Progress
Metals, Journal of
Mining Engineering

National Advisory Committee for Aeronautics Reports, Technical Memoranda and *Notes*
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News
Nuclear Science and Engineering
Nucleonics

Oil and *Gas* Journal
Optical Society of America, Journal of

Petroleum (British)
Petroleum Engineering
Petroleum Refiner
Petroleum Technology Journal of
Petroleum Week
Physical Chemistry, Journal of
Physics and Chemistry of Solids (British)
Pipe Line Industry
Pipeline News
Power
Producers Monthly
Product Engineering
Progress (Pakistani)
Public Utilities Fortnightly

Refrigerating Engineering
Research, Journal of
Research & Engineering
Review of Scientific Instruments
Revue Generale du Gaz (Belgian)
Rivista dei Combustibili (Italian)

Science
Scientific Instruments, Journal of (British)
Svenska Gasverksföreningens Månadsblad (Swedish)

U.S. Bureau of Mines Bulletins, Information Circulars and *Reports* of *Investigations*
U.S. Patents
Usines a Gaz, Journal des (French)
Uspekhi Khemii (Russian)

World Oil
World Petroleum

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